A PERPECTIVE ON THE FUTURE OF WIND IN HAWAII

HREA COMMENTS

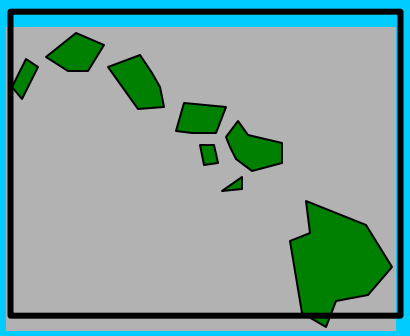
HAWAII WIND WORKING GROUP

HONOLULU, HAWAII

APRIL 8, 2002

AGENDA

- HREA'S MISSION AND OBJECTIVES
- HISTORY – WHAT HAVE WE LEARNED?
- FUTURE – HOW DO WE INVENT IT?

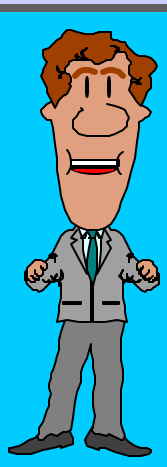


HREA MISSION

HREA WILL PR0MOTE, THROUGH EDUCATION AND ADVOCACY, THE UTILIZATION OF RENEWABLES FOR A SUSTAINABLE, ENERGY-EFFICIENT, ENVIRONMENTALLY-FRIENDLY, ECONOMICALLY-SOUND FUTURE FOR HAWAII

HREA OBJECTIVES

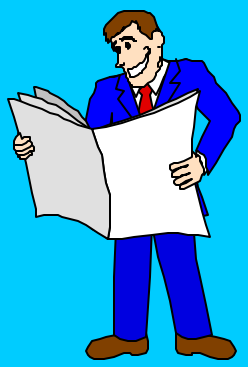
- EDUCATE STAKEHOLDERS IN HAWAII REGARDING THE ENERGY, ENVIRONMENTAL AND ECONOMIC BENEFITS OF RENEWABLES, AND
- SUPPORT THE INCREASED USE OF RENEWABLES IN HAWAII FOR ALTERNATIVE PATHS TO HEATING SOURCES, ELECTRICITY AND FUELS



HREA MEMBERS

INDIVIDUALS PLUS:

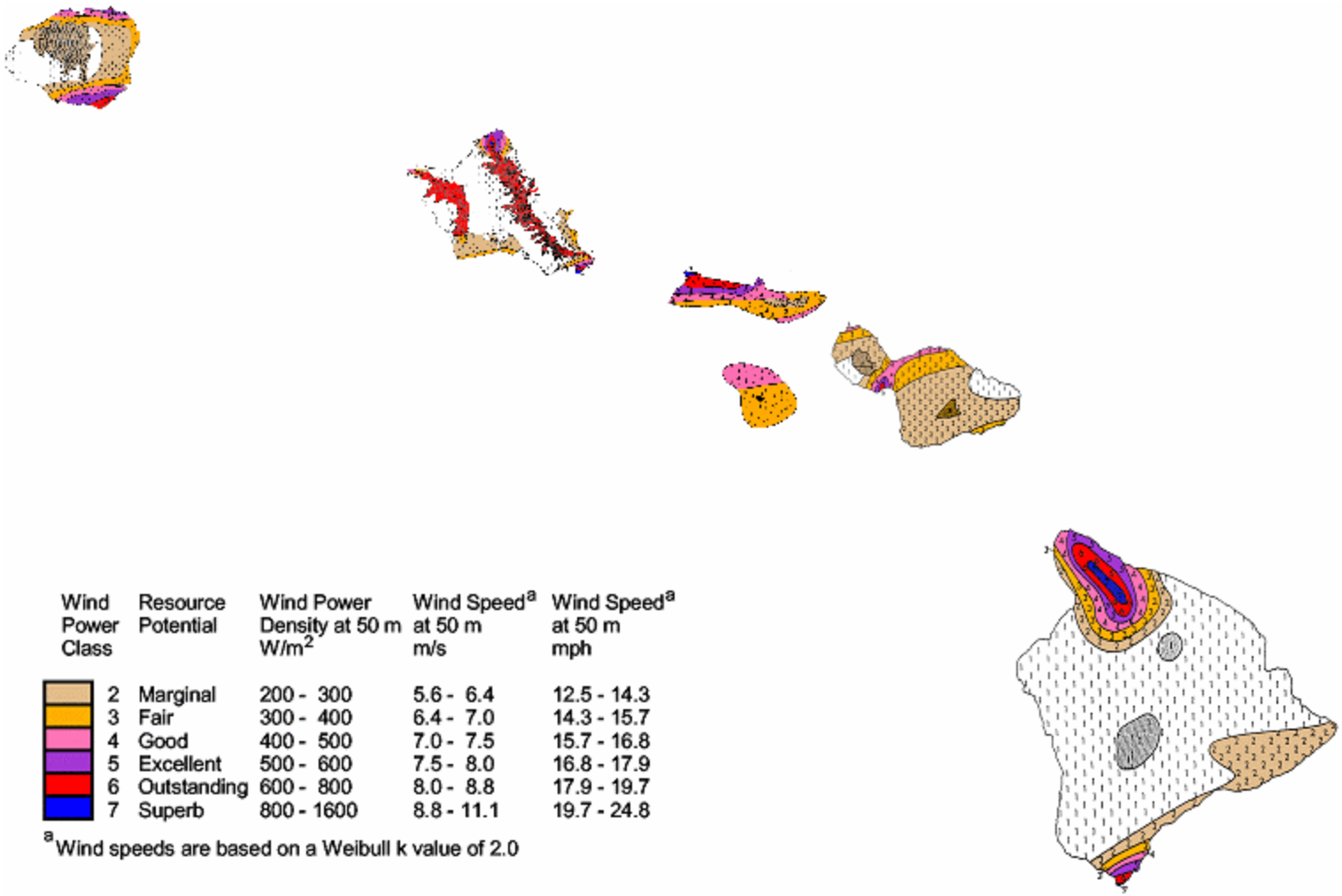
- **APOLLO ENERGY CORPORATION**
- **ENRON WIND CORPORATION**
- INTER ISLAND SOLAR SUPPLY
- POWERLIGHT CORPORATION
- WAILUKU RIVER HYDRO



HISTORY – WHAT HAVE WE LEARNED?

- **1980's – HAWAII'S WINDFARMS**
  - **LIKE IN CA, DEVEOPERS HAD PROBLEMS WITH PROTOTYPE TURBINES AND SITING ARRAYS**
  - **HOWEVER, PROJECTS WERE NOT RE-POWERED: ONLY TWO REMAIN ON-LINE (LALAMILO AND S. POINT)**
- **1994 – WIND WORKSHOP**
  - **BETTER TURBINES, LOWER COSTS**
  - **DO INTERCONNECTION STUDIES**
  - **CONSIDER NEW IPP PROPOSALS**

1981 MAP OF HAWAII'S WIND RESOURCE



Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m^2	Wind Speed[a] at 50 m m/s	Wind Speed[a] at 50 m mph
2	Marginal	200 - 300	5.6 - 6.4	12.5 - 14.3
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	800 - 1600	8.8 - 11.1	19.7 - 24.8

[a] Wind speeds are based on a Weibull k value of 2.0

Source: *Wind Energy Resource Atlas*, Battelle Pacific Northwest Laboratories, 1981

ADDITIONAL WIND DATA

Island	Location	Dates	Height	Average mph	Measurement shows power class:
Hawaii	Kahua Ranch	1/28/92 - 6/1/94	90 feet	15.80	
Hawaii	Kahua Ranch	1/28/92 - 6/1/94	140 feet	16.22	5
Hawaii	Lalamilo Wells	11/14/91 - 6/1/94	90 feet	16.88	
Hawaii	Lalamilo Wells	8/23/91 - 3/24/94	140 feet	17.19	
Hawaii	Lalamilo Wells	10/31/93 - 12/11/94	60 feet	20.51	
Hawaii	Lalamilo Wells	10/31/93 - 12/11/94	90 feet	21.77	6 - 7
Hawaii	North Kohala	10/30/93 - 12/11/94	60 feet	20.38	
Hawaii	North Kohala	10/30/93 - 12/11/94	90 feet	22.21	7+
Oahu	Kahuku	12/05/93 - 12/12/94	60 feet	15.00	
Oahu	Kahuku	12/05/93 - 12/12/94	90 feet	16.35	4
Oahu	Kaena Point	10/10/93 - 12/11/94	60 feet	13.87	
Oahu	Kaena Point	10/10/93 - 12/11/94	90 feet	15.07	4
Kauai	Anahola	11/07/93 - 11/23/94	60 feet	11.75	
Kauai	Anahola	11/07/93 - 11/23/94	80 feet	12.98	2
Kauai	N. of Hanapepe	11/06/93 - 12/31/94	60 feet	16.38	
Kauai	N. of Hanapepe	11/06/93 - 12/31/94	90 feet	16.96	5
Maui	NifTal	9/11/93 - 1/16/95	60 feet	12.88	
Maui	NifTal	9/11/93 - 1/16/95	90 feet	14.82	3
Maui	Puunene	9/11/93 - 9/30/94	60 feet	11.03	
Maui	Puunene	9/11/93 - 1/16/95	90 feet	12.46	3

Data available on the Web: www.hawaii.gov/dbedt/ert/winddata

HISTORY – CONTINUED

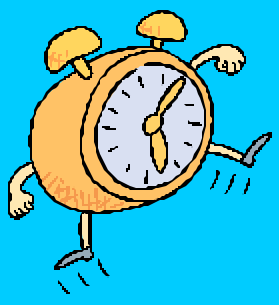
- **LATE 1990's to TODAY – WHERE ARE WE?**
  - **KAHUA RANCH (ON-LINE – 2002?)**
  - **HAWI (PPA), SOUTH POINT (PPA)**
  - **MAUI (PPA/LEASE), KAUAI (SITE)**
  - **OAHU (IN SEARCH OF A SITE)**
  - **WHAT MAKES A PROJECT VIABLE?**

What makes a project viable?

Seat = Project Design/Ownership; Three Legs = Site, Market and Financing

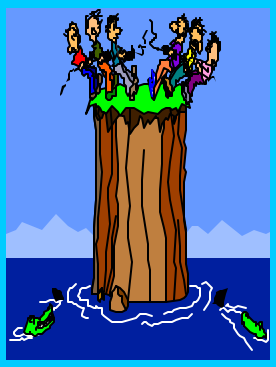
FUTURE – HOW DO WE INVENT IT?

- CHANGE THE PARADIGM!
- SOLVE THE TECHNICAL PROBLEMS!
- CREATE A SUSTAINABLE ENERGY FUTURE -- CONSERVE, BE ENERGY EFFICIENT AND WEAN HAWAII OFF OF FOSSIL ENERGY!



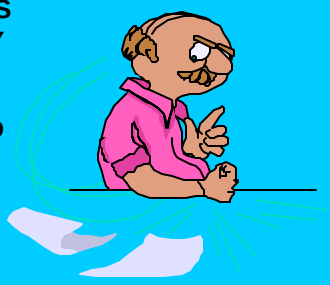
CHANGE THE PARADIGM!

- TODAY
  - RENEWABLES ARE USED WHEN CONVENIENT
  - WE LAG THE MAINLAND IN NEW RENEWABLE FACILITIES
  - WE HAVE LIMITED COMPETITION IN A REGULATED MARKET
  - WE LIVE IN A PURPA WORLD WHERE UTILITY HAS UPPER HAND IN NEGOTIATIONS



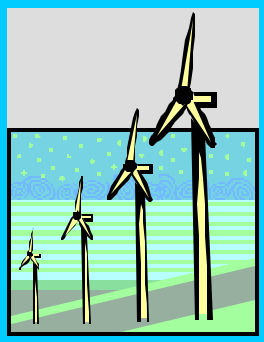
CHANGE THE PARADIGM - CONTINUED!

- **TOMORROW**
  - **RENEWABLES ARE #1, FOSSILS PROVIDE BACK-UP UNTIL THEY ARE NOT NEEDED**
  - **INCREASED COMPETITION AND INNOVATION WITH RPS IN A RESTRUCTURED MARKET**
  - **UTILITY AND IPPs WORK IN PARTNERSHIP**



SOLVE THE TECHNICAL PROBLEMS!

- **STRENGTHEN THE GRID TO ACCEPT MORE DG - GRID MUST BE ROBUST TO ALLOW OMNI-FLOW OF ELECTRONS**
- **ADD STORAGE TO ACCEPT MORE WIND AND OTHER INTERMITTENTS - PUMPED-STORAGE AND BATTERIES NOW, HYDROGEN LATER**
- **ADD SOPHISTICATED CONTROLS TO MAINTAIN GRID STABILITY - ALREADY PROVEN IN REMOTE, SMALL GRIDS, E.G., ALASKA**



CREATE A SUSTAINABLE ENERGY FUTURE!

- POTENTIAL FOR WIND IN HAWAII – FIRST CUT
  - ARE THERE LIMITS TO THE PENETRATION OF WIND?
  - WHAT PERCENTAGE OF OUR ELECTRICTY CAN WE GENERATE FROM WIND?
  - HOW WOULD IT VARY BY ISLAND?
  - HOW COULD WE BE INNOVATIVE?

CREATE A SUSTAINABLE ENERGY FUTURE!

- ANSWERS
  - YES
  - 100% -- WELL, MAYBE 150% WITH HYDROGEN PRODUCTION
  - WE COULD EASILY EXCEED 100% ON HAWAII, MOLOKAI, LANAI, AND MAYBE MAUI; OAHU (TBD)
  - LOOK AT HARBOR AND OFF-SHORE INSTALLATIONS, INTER-ISLAND CONNECTIONS, AND WIND-HYDROGEN SUPER TANKERS

TIME'S AWASTIN (C. P. PETERSEN)!

- **A MODEST PROPOSAL – LET'S**
  - **MAKE THE BIG ISLAND THE MODEL FOR HOW TO ACHIEVE 100% RENEWABLES BY DATE CERTAIN!**
  - **FORM A PARTNERSHIP (UWIG, EPRI, NREL, HELCO, SOH, COH, INDUSTRY, COMMUNITY, ETC.) TO PREPARE AND IMPLEMENT A PLAN TO MAXIMIZE THE USE OF WIND AND OTHER INTERMITTENT SOURCES!**
  - **START TODAY!**